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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/598,835	09/13/2006	Udo Van Steven-Daal	DE 040079	1998

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EXAMINER	
TANINGCO, ALEXANDER H	

ART UNIT	PAPER NUMBER
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/598,835	VAN STEVEN-DAAL ET AL.	
	Examiner	Art Unit	
	ALEXANDER H. TANINGCO	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendments filed 01/03/2008 have been entered.

Claim Objections

Claim 1 is objected to because of the following informalities: In claim 1, line 7; the phrase "data on based on", was claimed perhaps - - data based on - - was meant Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al. (Coherent Scatter Computed Tomography Applying a Fan-Beam Geometry) and Sakaida (US 2002/0085671) in view of Sasada (US 7,248,726).

With regards to claims 1, 6, 9, and 10, Schneider et al. disclose a method of reconstructing coherent scatter computed tomography data of an object of interest, the method comprising the acts of: acquiring attenuation data of the object of interest from primary radiation transmitted through the object of interest (pg 754 Line 5); performing a beam hardening compensation of scatter radiation data based on the acquired attenuation data (pg 754 Line 5-6); wherein the scatter radiation data is based on scatter radiation scattered from the object of interest (pg 754 Abs.); and reconstructing

the coherent scatter computed tomography data by using the compensated scatter radiation data (Abs.; pg 754 Line 11). Schneider et al. disclose a method comprising: simulations using phantoms for various materials (pg 755 Lines 1-2; pg 755 Line 10); scatter projections for different energies weighted with intensity and energy dependent attenuation (pg 757 Lines 22-23); and scaling due to beam hardening to agree with input peak positions and using a mean energy value depending on a traversed object thickness and a spectral intensity distribution function (pg 757 Lines 34-35; Fig. 2-Fig. 4). Schneider et al. fail to explicitly teach a method further comprising: performing beam hardening compensation of scatter radiation data based on an energy shift of an equivalent object

Sakaida teaches a method comprising performing a beam hardening compensation [0017] of scatter radiation data on based on the acquired attenuation data and based on an energy shift of an equivalent object equivalent to the object of interest [0076]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Schneider et al. to include the features of Sakaida. One would have been motivated to make such a modification to improve image quality as taught by Sakaida [0024].

Moreover, Sasada teaches a method comprising an energy subtraction process and image density shift quantity over the entire area and is calculated in accordance with other parameters concerning image density shift quantity and the adverse effects of beam hardening phenomenon and scattering are capable of being suppressed (Col. 10 Lines 45-55). It would have been obvious to one of ordinary skill in the art, at the time

of invention to modify the invention of Schneider et al. to include the features of Sasada. One would have been motivated to make such a modification to improve image quality as taught by Sasada (Col. 4 Lines 45-50).

With regards to claims 2 and 7, Schneider et al. as modified above disclose a method comprising a step wherein the energy shift occurring with the equivalent object caused by a the beam hardening effect is known (pg 757 Line 12 and 20-26; Fig. 2).

With regards to claim 3, Schneider et al. as modified above disclose a method comprising the acts of: determining a mean attenuation caused by the object of interest based on the attenuation data (pg 757 Line 29);
determining an equivalent thickness of a pre-selected material of the equivalent object based on the mean attenuation (pg 757 Line 12 and 20-26; Fig. 2);
determining the energy shift based on the equivalent thickness of the pre-selected material; and compensating the scatter radiation data by using the energy shift (pg 757 Lines 34-35).

With regards to claim 4, Schneider et al. as modified above disclose a method further comprising the acts of: reconstructing a volume data set comprising absorption coefficients of the object of interest (Abs.; pg 754 Line 11); determining radiation spectra for scattered photons of the scatter radiation [0017 Sakaida]; determining mean energies of the scattered photons based on the radiation spectra; and performing a reconstruction of the coherent scatter computed tomography data by using the mean energies (pg 758 Lines 28-29).

With regards to claims 5 and 8, Schneider et al. as modified above disclose a method further comprising the acts of determining, based on the attenuation data, a material which is located on a path of a scattered photon of the scatter radiation in the object of interest (pg 754 Line 6; pg 754 Lines 8-10); determining a mean energy of the scattered photon using an absorption spectrum of the material; and using the mean energy for the reconstruction (pg 758 Lines 28-29).

With regards to claims 11, 12, 13, and 14, Schiender et al. as modified above disclose a method comprising a step wherein the performing act includes correcting energy of the scatter radiation by the energy shift of the equivalent object [0076 Sakaida].

Response to Arguments

Applicant's arguments with respect to claims 1, 6, 9, and 10 have been considered but are moot in view of the new ground(s) of rejection.

Independent claims 1, 6, 9, and 10, now contain: performing beam hardening compensation of scatter correction radiation data based on an energy shift of an equivalent object equivalent to the object of interest.

New dependent claims 11-14 have been added.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following patents are cited to further show:

Casteele et al. (NPL)

- An Energy-based beam hardening model in tomography

Du et al. (US 7,065,234) (382/131)

- Scatter and Beam hardening correction

Elbakri et al. (US 6,507,633) (378/8)

- Attenuation coefficient is energy dependent and the X-ray beam is polyenergetic. Beam hardening is a process whereby the average energy of the X-ray beam increases as the beam propagates through a material. This increase in average energy is a direct consequence of the energy dependence of the attenuation coefficient (Col. 2 Lines 25-35)
- Measurements can be combined with analytic models for scatter that depend on the energy of the radiation used and the volume of scattering material and system geometry (Col. 21 Lines 1-42)

Fivez et al. (US 5,602,895) (378/98.4)

- Estimation of the scattered component and the effect of beam hardening
- Influence of beam hardening on a factor is larger when the spectrum is broader. The materials in an object cause the spectrum to shift to higher mean energies (Col. 17 Lines10-23)

Takeo (US 6,075,877) (382/130)

- Subtraction process is carried out in accordance with predetermined parameters and on image signal components of the radiation image signals, which image signal components represent corresponding picture elements in the radiation images, and a desired tissue pattern is thereby extracted or emphasized. The values of the parameters are altered in

accordance with a thickness of the object, and adverse effects of a beam hardening phenomenon and scattering of radiation are thereby reduced (Abs.)

- As the radiation passes through the object, the energy distribution of the radiation shifts to the high energy side as a whole – such phenomenon is referred to as beam hardening (Col. 3 Lines 55-60)

Macovski (US 3,965,358) (250/369)

- Energy spectral analysis
- Various regions of the energy spectrum are separately counted in order to provide an accurate reconstruction of the cross-sectional density (Abs.)

Solomon et al. (US 6,157,703) (378/158)

- Beam Hardening filter

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEXANDER H. TANINGCO whose telephone number is (571)272-8048. The examiner can normally be reached on Mon-Fri 8:00-4:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Alexander H Taningco/
Examiner, Art Unit 2882

/Courtney Thomas/
Primary Examiner, Art Unit 2882